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**Please find below and/or attached an Office communication concerning this application or proceeding.**

The time period for reply, if any, is set in the attached communication.

| Office Action Summary | Application No. | Applicant(s) | |
|---|---|---|---|
| | 10/521,882 | HAASE, FRANK | |
| | Examiner | Art Unit | |
| | Carl D. Price | 3749 | |

*-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --*

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

1)☒ Responsive to communication(s) filed on *03/28/2008 (RCE)*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

4)☒ Claim(s) *26-76* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *26-76* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

**Application Papers**

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application

6) ☐ Other: _____.

## DETAILED ACTION

### ***Continued Examination Under 37 CFR 1.114***

A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on **03/28/2008** has been entered.

### ***Response to Arguments***

Applicant's arguments with respect to newly added claims **26-76** have been considered but are moot in view of the new ground(s) of rejection.

With respect to the newly added claims applicant's remark include merely the following:

> "Applicant respectfully submits that the new claims render the current rejections moot. Applicant respectfully requests consideration and allowance of the new claims."

It is noted however that the newly presented independent claims now recite that "the conditions produced flue gases comprising less carbon monoxide than flue gases produced under the same conditions using petroleum derived gas oil as the fuel." Therefore, with the level of ordinary skill in the art regarding Fischer-Tropsch-derived fuel being known and expected to produced flue gases comprising less carbon monoxide than flue gases produced under the same conditions using petroleum derived gas oil as the fuel the examiner once again acknowledges the well-established fact that carbon monoxide poses a threat to human safety, when too high a level occurs in a confined space. Indeed, the examiner again notes that the person having ordinary skill in the art of combustion processes would have been, at the time of the invention, well aware of the concerns that all types of combustion processes (i.e.- including internal combustion, industrial and residential) producing relatively high levels, or indeed any carbon emissions (carbon monoxide and/or carbon dioxide), also result in a negative impact on the environment,

when concentrations levels rise in the atmosphere. In this regard, the person having ordinary skill in the art at the time of the invention would have been motivated toward applying known and readily available solutions to this problem. That is, whether the exhaust gases containing any noxious and/or harmful emissions including, for example, carbon particles, carbon monoxide, carbon dioxide, nitrogenous and sulfurous emissions, are expelled into a confined space or into the environment. Furthermore, regarding the buildup of carbon monoxide in enclosed environments (such as a living space) during operation of a combustion heating appliance, the mere fact that a combustion device using a fuel likely to generate relatively high concentrations of carbon monoxide is not itself does not preclude its operation. As outlined in the now attached Department of Energy Technical Fact Sheet titled "Combustion Equipment Safety – Provide Safe Installation for Combustion Appliances" (October 2000, DOE/GO-102000-1784) it is known to compensate for any undesirable effects of combustion emissions in spaces by at least providing means for monitoring emission levels and/or assuring proper ventilation in the space. Therefore, the examine does not agree that the teachings found in the prior art of **Suppes et al** (Compression-Ignition Fuel Properties of Fischer-Tropsch Syncrude, Ind. Eng. Chem. Res. 1998, 37 2029-2038) in view of **US004764266 (Chen et al), US005807413 (Wittenbrink et al), US006787022 (Berlowitz et al)** would have at the time of the invention causes a person having ordinary skill in this field of endeavor to turn away from, and therefore ignore any implied or explicit benefits suggested and taught therein. More specifically, these prior art teachings not only explicitly recommend Fischer-Tropsch derived liquid fuels as advantageous to lowering combustion emissions, due to their inherent low sulfur, low nitrogen and very low aromatics content, but also define and describe the properties and composition of these fuels in a manner not unlike, and indeed, the same as the Fischer-Tropsch derived fuels specified in applicant's claims. Indeed, notwithstanding the discussion appearing herein above, applicant's remarks directed to diesel fuel are not commensurate with the scope of the claimed invention, since it appears that applicant's claimed fuel (Fischer-Tropsch derived) is the same as, or at least can not be distinguished from, the prior art diesel fuel.

And, applicant's attention is once again directed to the EPA fact sheet publication titled "Clean Alternative Fuels: Fischer-Tropsch" (EPA420-F-00-036 March 2002 www.epa.gov) which states the following:

> "**Fischer-Tropsch technology** converts coal, natural gas, and low-value refinery products into a high-value, clean-burning fuel. The resultant fuel is colorless, odorless, and low in toxicity. In addition, it is **virtually interchangeable with conventional diesel fuels** and can be blended with diesel at any ratio with little to no modification.
>
> **Fischer-Tropsch fuels offer important emissions benefits** compared with **diesel, reducing nitrogen oxide, carbon monoxide**, and particulate matter."

Also, with regard to the known important emissions benefits of Fischer-Tropsch derived fuels, applicant's attention is directed to at least the section headed "6. Ultra-Low-Aromatic Synthetic Diesel Fuel", beginning on page IV-17 of the now appended California Air Resources Board publication Titled "Appendix IV – Fuels Report: Appendix to the Diesel Risk Reduction Plan" (October 2000). Here it is noted that Fischer-Tropsch (F-T) diesel fuels, **when compared to non-Fischer-Tropsch derived fuel** (CARB diesel), resulted in **36% less carbon monoxide emissions.**

Furthermore, with regard to the known important emissions benefits of Fischer-Tropsch derived fuels, applicant's attention is also directed to now appended WO 01/83648 (Berlowitz et al) (11/08/2001) which, on page 17, discusses and shows (Table 6) that "Fuel A, the 'neat' Fischer-Tropsch demonstrated the **lowest emissions in comparison to the other fuels**." (Note: the term "neat" in the combustion fuel field of endeavor is understood to mean "pure").

## *Claim Rejections - 35 USC § 103*

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims **26-76** are rejected under 35 U.S.C. 103(a) as being unpatentable over **US004629414 (Buschulte)** in view of **Suppes et al** (Compression-Ignition Fuel Properties of Fischer-Tropsch Syncrude, Ind. Eng. Chem. Res. 1998, 37 2029-2038) in view of **US004764266 (Chen et al), US005807413 (Wittenbrink et al), US006787022 (Berlowitz et al)** and **US003808802 (Tanasawa),** as supported by any and all of the following **"Clean Alternative Fuels: Fischer-Tropsch"** (EPA420-F-00-036 March 2002 www.epa.gov), California Air Resources Board publication Titled **"Appendix IV – Fuels Report: Appendix to the Diesel Risk Reduction Plan"** (October 2000) and **WO 01/83648 (Berlowitz et al).**

**US004629414 (Buschulte)** show and disclose a liquid fuel blue flame burner relying on hot gases from the flame front flowing back outside the mixing tube to a recirculation port on the upstream end of the tube.

**US004629414 (Buschulte)** discloses:

(3) Burners of the above-described type are known from, e.g. **German Pat. No. 27 00 671** and **German Offenlegungsschrift No. 29 18 416**.

(4) **In these prior-art burners**, air is supplied to the fuel that is fed through a centrally-disposed nozzle. The air is supplied through openings provided in an orifice plate that surrounds the nozzle. Air and fuel are mixed in a mixing chamber downstream from the nozzle, the mixing chamber being situated in a mixing tube. In operation, a flame front is formed in the area of the downstream end of the mixing tube. **Hot gases from the flame front flow back outside the mixing tube to a recirculation port on the upstream end of the tube.**

(11) An air duct is arranged ahead of the openings to provide an approximately parallel combustion air flow before the air passes through the openings and enters the mixing chamber. This reduces the air flow disturbances and prevents turbulence being carried over into the mixing chamber. Otherwise, the turbulence would persist in the flame and in the recirculating stream and would result in an increased combustion noise level.

(2) This invention applies to many various **oil or gas** burners and is explained below based on an exemplary Bunsen type burner, i.e. a burner in which oil is burned completely with **blue flame**. **The invention is not, however, limited to such burner type.** The desired noise reduction may

> be obtained using the features defined herein, also in the case of, for instance, preheating burners or torches and **yellow-flame** burners.
>
> (Highlighting and Underlining Added)

**US004364725 (Buschulte)** show and disclose a liquid fuel blue flame burner relying on hot gases from the flame front flowing back outside the mixing tube to a recirculation port on the upstream end of the tube.

**US004364725 (Buschulte)** discloses:

> **Blue-flame oil burners** require that the oil reaching the point of combustion is completely vaporized before it reaches that point. The operation of an oil burner with a blue flame has the advantage that the burner is able to operate with very small excess of air over that required for complete combustion so that practically stoichiometric combustion takes place. Since combustion takes place with very small excess of air a very hot flame is produced which utilizes the energy content of the fuel optimally and leads to improved heat transfer. In addition, the waste gases **in comparison** with waste gases from an optimally adjusted burner with a **yellow flame** contain **extremely little harmful material** (soot, **NO.sub.x,** SO.sub.3).
>
> (17) With stoichiometric combustion in the flame tube 42 practically no free oxygen is present. This is another reason why the flame tube 42 may be made of heat resistant steel without risk of wear due to scaling or oxidation. Alternatively, the flame tube 42 may be made from a heat resistant ceramic material or a steel tube having a heat resistant ceramic coating may be used. It is possible to arrange for the flame tube to be cooled, for example, the **heating water.** In this case the flame tube may, for example, form part of the **heat exchange system of the boiler**. With cooled flame tubes, it is not necessary to use highly heat resistant materials.
>
> (15) **With blue flames**, **monitoring of the flame** cannot be carried out optically. **To guarantee a reliable automatic operation** of the blue-burning flame monitoring is possible by means of an **ionisation detector 44** which is **connected in known manner to a control device 46** by means of which, when the flame is extinguished, the supply of oil is cut off by closing the valve 18 and the motor 12 is switched off. After the flame has been produced the ignition device is also switched off by the control device in known manner.

**Suppes et al** (Compression-Ignition Fuel Properties of Fischer-Topsch Syncrude, Ind. Eng. Chem. Res. 1998, 37 2029-2038) teaches, from applicant's same liquid combustion fuel field of endeavor, burning light Fischer-Tropsch fuels or Syncrude (see page 2030, column 1, lines 27-36) in combustion apparatus such as internal combustion engines, as a **suitable alternative to diesel** and **gasoline fuels** (see page 2031, column 2, lines 4-35) in for example conventional diesel engines. Known light Fischer-Tropsch fuels disclosed by **Suppes et al** include the following properties:

- > 70% Fischer-Tropsch syncrude(see page 2031, column 2, lines 4-35), or 90% (by mass) of the light syncrude composition (see page 2029, column 2, lines 1-4);

- near-zero aromatic contents; and
- a boiling point of 170.6-314.9° C (Table 1).

**US004764266 (Chen et al)** teaches, from applicant's same Fischer-Tropsch derived fuel field of endeavor, a process for using or burning middle distillate Fischer-Tropsch derived fuel having typically boiling in the 165.degree. to 345.degree. C. (about 330.degree. to 650.degree. F.) with lesser proportions of naphtha as a **"home heating oil"** (see column 10, line 16-34). This **middle distillate** fraction is, however, relatively **low in sulfur** and generally meets product specifications for use as a **light fuel oil**, e.g. **home heating oil**, **diesel** and **jet fuels**. **US004764266 (Chen et al)** acknowledges the presence of non-mineral fractions, or additives, in the Fischer-Tropsch distillate (e.g. – unconverted fractions).

**US005807413 (Wittenbrink et al)** teaches, from applicant's same Fischer-Tropsch derived fuel field of endeavor, that fuels produced by the Fischer-Tropsch process have essentially nil sulfur and nitrogen. See also, for example, **US006787022 (Berlowitz et al)** which teaches Fischer-Tropsch fuel characterized by "1) paraffins at least 90 + wt %, preferably at least 95 + wt %, more preferable at least 99 + wt % sulfur .ltoreq.10 ppm (wt), preferably <5 ppm, most preferably < 1 ppm nitrogen .ltoreq.10 ppm (wt), preferably <5 ppm, most preferably < 1 ppm aromatics <1%, preferably <0.1% cetane number >65, preferably >70, more preferably >75"). **US006787022 (Berlowitz et al)** yields of distillate fuels with excellent cold flow properties are produced from wax containing paraffins derived from the Fischer-Tropsch process to produce a full boiling range diesel fuel, preferably a **320-700** degrees F (i.e. **160-371** degree C) fraction, with the unique combination of high cetane number, very low cloud and cold filter plugging point (CFPP) performance and full boiling range cut exhibiting **superior emissions performance.**

**US005807413 (Wittenbrink et al)** discloses:

(7) By virtue of using the **Fischer-Tropsch** process, the recovered distillate **has essentially nil sulfur and nitrogen**. These hereto-atom compounds are poisons for Fischer-Tropsch catalysts and are removed from the synthesis gas that is the feed for the Fischer-Tropsch process. (Sulfur and nitrogen containing compounds are, in any event, in exceedingly low concentrations in synthesis gas.) Further, **the process does not make aromatics**, or as usually operated, virtually no aromatics are produced. Some olefins are

produced since one of the proposed pathways for the production of paraffins is through an olefinic intermediate. Nevertheless, olefin concentration is usually relatively low.
(19) Although the studies in the three SAE papers did not deliberately vary either the density or the distillation profile of the fuels, these properties, of necessity, were varied as a natural consequence of changing the fuel cetane number and aromatic content. The results of these studies were that **particulate matter (PM) emissions** were primarily affected by the cetane number, sulfur content, oxygen content and aromatic content of the fuels. However. **, neither fuel density nor distillation profile had any effect on particulate matter (PM) emissions in these studies.**

(Highlighting and Underlining Added)

**US003808802 (Tanasawa)** teaches, from applicant's same liquid combustion fuel field of endeavor, that is known to operate combustors used for various purposes such as for home use, for industrial use, for gas turbines and for jet engines, and operating under either "yellow flame" or "blue flame" conditions, with "all kind of fuels, such as gas fuel, gasoline, lamp oil, light oil, heavy oil and the like" and "can be equally burned in a wide range of air -fuel ratio".

**US003808802 (Tanasawa)** discloses the following:

"(3) The present invention relates to a vortex combustor which can be used for various purposes such as **for home use**, for industrial use, for gas turbines and for jet engines."

"(4) 2. The Prior Art
"... moreover, a high intensity combustion is carried out in the combustion chamber of the vortex combustor, so that **all kind of fuels**, such as gas fuel, **gasoline, lamp oil, light oil, heavy oil and the like**, can be equally burned in **a wide range of air -fuel ratio**."

"(5) In case of the various conventional combustors, because of their structure and severe operating condition, only in the narrow range of air -fuel ratio, the combustion efficiency and the combustion intensity (the weight of fuel which can be burned per unit time in the unit volume,or calorific value of the said fuel; kcal/m.sup.3 -hr-atm) can be kept high in some degree. In the case of such combustors designed for gas turbines and for jet engines, it is necessary to supply a large amount of air into the combustion chamber in proportion to its output. If this air flow increases, combustion flame does not spread to the whole inside wall of the combustion chamber, and the mixture of air and fuel is not burned with high intensity, so the combustion efficiency and the combustion intensity becomes low. While there have been many studies about vortex combustors, a satisfactory combustor for practical use has not yet been provided, mainly because of the fact that these studies haven't cleared up some of the important characteristics of vortex combustors."

"(68) Since the fuel stays for a long period of time in the first and the second combustion chambers because of the swirling flow pattern, the combustion efficiency becomes as high as nearly 100 percent, whether the combustion condition in the combustion chamber is the **yellow flame** combustion or the **blue flame** combustion."

"(86) The vortex combustor of the present invention can be applied to various combustors using heat energy **for home** use or industrial use, and various combustors for heat motors using mechanical energy converted from heat energy, besides gas turbine engines for automobiles and for aircraft, which are described herein with relation to the first and second embodiments. For example, they can be **used as**

**various combustors using heat energy, such a boilers, burners, steam motors, heating apparatus and water boilers**. They **can also be used as the combustors for** heat motors using mechanical energy which is converted from heat energy, such as various steam turbines, gas turbines, jet engines and steam engines, which **can be employed in many fields,** for example, for aircraft, ships, motor vehicles, electric generation and for industrial motive force in various works."

(Highlighting and Underlining Added)

**"Clean Alternative Fuels: Fischer-Tropsch"** (EPA420-F-00-036) which states the following:

"**Fischer-Tropsch technology** converts coal, natural gas, and low-value refinery products into a **high-value**, **clean-burning fuel.** The resultant fuel is colorless, odor-less, and low in toxicity. In addition, it is **virtually interchangeable with conventional diesel fuels** and can be blended with diesel at any ratio with little to no modification.

**Fischer-Tropsch fuels** **offer important emissions benefits** compared with diesel, reducing nitrogen oxide, **carbon monoxide**, and particulate matter."

**California Air Resources Board publication Titled "Appendix IV – Fuels Report: Appendix to the Diesel Risk Reduction Plan"** (October 2000). Here it is noted that Fischer-Tropsch (F-T) diesel fuels, when compared to non-Fischer-Tropsch derived fuel (CARB diesel), resulted in **36% less carbon monoxide emissions**. See section "6. Ultra-Low-Aromatic Synthetic Diesel Fuel", beginning on page IV-17.

**WO 01/83648 (Berlowitz et al)** (11/08/2001) which, on page 17, discusses and shows (Table 6) that "Fuel A, the 'neat' Fischer-Tropsch demonstrated the lowest emissions in comparison to the other fuels." (Note: the term "neat" in the combustion fuel field of endeavor is understood to mean "pure").

In regard to claims **26-76**, for the purpose of reducing harmful combustion exhaust gas emissions (e.g. - sulfur, nitrogen, aromatics and **carbon monoxide**) formed during operation of known conventional home heating systems, it would have been obvious to a person having ordinary skill in the art to operate heating systems operated with a blue flame burner such as in **US004629414 (Buschulte),** or boiler heating systems as in **US004364725 (Buschulte),** or known conventional of the type directly heating a space by exhaust gases, to be fueled with Fischer-Tropsch fuel having no additives and "nil" or less than 1 ppm nitrogen and sulfur and low aromatic content and a density similar to that of home heating fuels (i.e. – between 0.65 and 0.8 $g/cm^3$ at $15^o$ C), in view of the teaching of the **Suppes et al ,US004764266 (Chen et al)** and

**US005807413 (Wittenbrink et al), US006787022 (Berlowitz et al), "Clean Alternative Fuels: Fischer-Tropsch"** (EPA420-F-00-036), **"Appendix IV – Fuels Report: Appendix to the Diesel Risk Reduction Plan"** (October 2000) and **WO 01/83648 (Berlowitz et al).** In addition, in view of the teaching of **US003808802 (Tanasawa),** it would have been obvious to a person having ordinary skill in the art to operate combustion systems used for various purposes such as for home use, for industrial use, for gas turbines and for jet engines with all kind of fuels such as a **Fischer-Tropsch fuel** and which generally meets product specifications for use as a **light fuel oil**, e.g. **home heating oil**, **diesel** and **jet fuels**, wherein the burner is capable of operating in a wide range of air-fuel ratio, or "lambda".

In regard to regard to claims **26-76,** since the 1) "lambda" (assumed for the sake of examination to refer to the ratio of an oxidant to fuel necessary for combustion), 2) the number of burner operations per hour, and 3) the type of flame detector used to detect the burner flame, would necessarily depend on numerous design concerns such as the operational characteristics of a given burner and heating system installation and the type of oxidant being used, and would necessarily and predictably result from optimization of a given burner and heating system installation, the claimed "lambda" values can be viewed as nothing more than merely a matter of choice in design and/or a result-effective variable, i.e., a variable which achieves a recognized result. Generally, differences in concentration or temperature will not support the patentability of subject matter encompassed by the prior art unless there is evidence indicating such concentration or temperature is critical. "[W]here the general conditions of a claim are disclosed in the prior art, it is not inventive to discover the optimum or workable ranges by routine experimentation." In re Aller, 220 F.2d 454, 456, 105 USPQ 233, 235 (CCPA 1955).

In regard to claims 38, 46, 54, 61 and 76, Official Notice is taken that ionization type sensors are well known means for detecting burner flames. Therefore, in view of that which is well known and for the known purpose, it would have been obvious to a person having ordinary skill in the art to detect the flame of a heating system burner.

## ***Conclusion***

See the attached USPTO Form 948 for prior art made of record and not relied upon which is considered pertinent to applicant's disclosure.

It is well known to provide liquid fuels with odor or aroma (see for example US001944175) and color markers (See for example US005560855), and yellow flame coloring additives, for the purpose of aiding in readily identifying the fuel, and for aiding in making the flame visible (see for example US2002/0090585 or US006488726).

**US004054407 (Carruba et al)** shows that it is known to minimizing nitrogen oxide emissions in combustors used in furnaces, boilers, gas turbines, etc. by operating the combustor such that a preliminary mixture of fuel and air is burned upstream of the catalyst to provide preheated gases for the fuel-air feed to the catalyst inlet, so that the feed mixture entering the catalyst has an elevated temperature within the desired range, in order to sufficiently high to vaporize relatively heavy fuel feeds. In **US004054407 (Carruba et al)** the preliminary mixture of fuel and air is burned upstream of the catalyst occurs as a controlled preburning which means that the temperature of the fuel-air feed at the "*inlet to the first stage catalyst*" of this process is raised to "*no more than*" preferably "*about 700 ° C (about 1,300 ° F)*", or no more than 572 ° F - 896 ° F. The controlled preliminary cool flame (572 ° F - 896 ° F.) **US004054407 (Carruba et al)** being sufficiently high to vaporize relatively heavy fuel feeds, meets the applicant's claim with regard to subjecting the droplet mixture to a cool flame under evaporation conditions effective to produce an evaporated gaseous mixture comprising oxygen and hydrocarbons, the cool flame having a temperature of between $300^0$ C and $480^0$ C (572 ° F - 896 ° F) when the pressure is 1 bar (i.e. - 1 atmosphere; or ambient pressure). Furthermore, with regard to this aspect of applicant's claimed invention, it is noted that the pressure of 1 bar merely indicates applicant intends the combustion process occur at atmospheric pressure.

With regard to liquid Fischer-Tropsch (F-T) fuels (also known as **Gas-to-Liquid fuels (GTL fuels))** as it relates to "middle distillate fuels" **fuel oils**, such **as diesel fuel**, **kerosene** and **jet fuel** which are fuels conventionally used to operate combustion heating **(boiler, hot air furnaces)** and power driven (jet or turbine) apparatus, applicant's attention is directed to the following range of teachings found in the prior art:

**20040128905** discloses the following:

[0002] **Known diesel fuel** components include the reaction products of Fischer-Tropsch methane condensation processes, for example the process known as **Shell Middle Distillate Synthesis** (van der Burgt et al, "The Shell Middle Distillate Synthesis Process", paper delivered at the 5.sup.th Synfuels Worldwide Symposium, Washington D.C., **November 1985**; see also the November 1989 publication of the same title from Shell International Petroleum Company Ltd, London, UK). **These Fischer-Tropsch derived gas oils are low in undesirable fuel components** such as **sulfur**, **nitrogen** and **aromatics** and are typically blended with other diesel base fuels, for instance petroleum derived gas oils, to modify the base fuel properties.

**US004976882 (Martella et al)** teaches that commonly known normally liquid fuel oils are diesel fuels, distillate fuels and heating oils are normally generally derived from petroleum sources, e.g., normally liquid petroleum distillate fuels, although they may include those produced synthetically by the Fischer-Tropsch **(F-T)** derived fuels.

**US004976882 (Martella et al)** discloses the following:

"… The **normally liquid fuel oils** are generally derived from **petroleum sources,** e.g., normally **liquid petroleum distillate fuels, though they may include those produced synthetically** by the **Fischer-Tropsch** and related processes, the processing of organic waste material or the processing of coal, lignite or shale rock. Such fuel compositions have varying boiling ranges, viscosities, cloud and pour points, etc., according to their end use as is well known to those of skill in the art. Among **such fuels are those commonly known** as **diesel fuels**, **distillate fuels**, **heating oils**, **residual fuels**, bunker fuels, etc., which are **collectively referred to herein as fuel oils**. The **properties of such fuels** are well known to skilled artisans as illustrated, for example, by **ASTM Specification D #396-73, available from the American Society for Testing Materials, 1916 Race Street, Philadlephia, Pa. 19103."**

Particularly preferred fuel oils include **middle distillates boiling** from about **120.degree. to 725.degree. F. (e.g., 375.degree. to 725.degree. F.),** including **kerosene**, diese**l fuels, home heating fuel oil**, jet fuels, etc., and most preferably whose 20% and 90% distillation points differ by **less than 212.degree. F**., and/or whose 90% to final boiling point range is between about 20.degree. and 50.degree. F. and/or whose final boiling point is in the range of **600.degree. to 700.degree. F.**

**US006392108 (O'Rear)** discloses the following:

(4) The **majority of combustible fuel** used in the world today is derived from **crude oil**. There are **several limitations to using crude oil** as a fuel source. Crude oil is in limited supply; it **includes aromatic compounds** that may be harmful and irritating, and it **contains sulfur** and **nitrogen**-containing compounds that can **adversely affect the environment**, for example, by producing acid rain.

(5) **Combustible liquid fuels** can **also be prepared from natural gas**. This preparation involves converting the natural gas, which is mostly methane, to synthesis gas, or syngas, which is a mixture of **carbon monoxide** and hydrogen. **An advantage** of using **products prepared from**

**syngas** is that **they do not contain nitrogen** and **sulfur** and **generally do not contain aromatic compounds**. Accordingly, **they have minimal health and environmental impact.**

(6) **Fischer-Tropsch** chemistry is **typically used to convert the syngas** to a product stream that **includes combustible fuel**, among other products. These Fischer Tropsch products have **very low** levels of **sulfur**, **nitrogen**, **aromatics** and **cycloparaffins**. The **Fischer Tropsch derived fuels** are considered **"green fuels"** and are **desirable as environmentally friendly**.

(54) **"Fischer-Tropsch derived products"** mean any hydrocarbonaceous products derived from a Fischer Tropsch process. Fischer Tropsch derived products include, for example, Fischer Tropsch naphtha, **Fischer Tropsch jet fuel**, **Fischer Tropsch diesel fuel**, Fischer Tropsch solvent, Fischer Tropsch lube base stock, Fischer Tropsch lube base oil, Fischer Tropsch LPG, **Fischer Tropsch synthetic crude**, and mixtures thereof.

**US 20020111521 (O'Rear)** discloses the following:

[0022] The term **"distillate fuel/distillate fuel fraction"** means a hydrocarbon with **boiling points** between about 250.degree. F. and 1100.degree. F., **preferably 300.degree. F. and 700.degree. F**. The term **"distillate"** means that typical conventional fuels of this type can be generated from vapor overhead streams of petroleum crude distillation. In contrast, residual fuels cannot be generated from vapor overhead streams of petroleum crude distillation, and are a non-vaporizable remaining portion. Within the **broad category of distillate fuels** are **specific fuels** that include: naphtha, **jet fuel**, **diesel fuel**, **kerosene**, aviation **gasoline**, **fuel oil**, and blends thereof. **Distillate fuel as used herein** may mean distillate fuels prepared by **Fischer Tropsch processes as well** as **distillate fuels generated from conventional petroleum crude distillation** as appropriate in the context.

**US005952539 (Selmandi et al)** discloses:

"Typical feed stocks suitable as feedstocks to the steam cracking units of the present invention include light paraffins, such as ethane and liquid petroleum gases (LPG), gasolines, naphthas, and **gas oils** (i.e., **middle distillates**). As used in this application, **"gas oil"** refers to both the so-called light gas oils having **an average boiling point from about 230.degree. C. to 340.degree. C.**, as well as the so-called heavy **gas oils having an average boiling point from about 315.degree. C. to about 545.degree. C**. **Middle distillates** are **those fuels typically used** as **kerosene**, **home heating oils**, **diesel** motor fuels.

**US 6652609 (Caprotti)** discloses:

"**Middle distillate fuel oils generally boil within the range of about 100.degree. C. to about 500.degree. C., e.g. 150.degree. to about 400.degree. C.**, for example, those having a relatively high Final Boiling Point of above 360.degree. C. (ASTM D-86). ... **The most common middle distillate fuels** are **jet fuels**, **diesel** fuels and **heating oils**. The **heating oil** may be a straight **atmospheric distillate**, **or** it may contain minor amounts, e.g. up to 35 mass %, of vacuum gas oil or **cracked gas oils** or of both.

**US 6277894 (Agee et al)** discloses the following:

As **concerns over pollution** caused by traditional fossil fuels increases and as sources of crude oil decrease, there has been increased interest in other sources of energy. One promising source of energy is the **synthetic production of fuels**, lubricants, and **other products from natural gas**

> (referred to at times as **gas-to-liquids** or **GTL)** preferably through the **Fischer-Tropsch process**. See for example U.S. Pat. Nos. 4,883,170 and 4,973,453, which are incorporated by reference herein for all purposes.
>
> An exciting aspect of the products that may be made from or as part of the Fischer-Tropsch products are synthetic fuels and blends, including Fischer-Tropsch compression ignition fuels, Fischer-Tropsch spark ignition fuels, feedstocks for fuel cells, aviation fuel (turbine and spark-ignition) and railroad fuels. The sulfur-free clean nature of the synthetic fuels thus made are advantageous.

**Kerosene** is defined as:

"A **thin oil distilled** from petroleum or shale oil, used as a **fuel for heating** and cooking, in lamps, and as a denaturant for alcohol. Also called coal oil, lamp oil."
(The American Heritage® Dictionary of the English Language Hardback, 0-395-82517-2 Publication date: 2003)

In view of the forgoing information, middle distillate fuels of the type having properties suitable for operating combustible heating and power generation systems would have been understood, by a person having ordinary skill in the art at the time of the invention, to be fuels included in the group of **gasoline, kerosene**, **GTL** (gas –to-liquid), **Fischer-Tropsch** derived fuels, heating or residential liquid fuels. That is, at the time of the invention the person having ordinary skill in the art would have known and understood that liquid heating fuels are necessarily selected from available hydrocarbon middle distillate fuels which include both normally liquid petroleum distillate fuels and those produced synthetically by the Fischer-Tropsch and have boiling points between about 120 and 725 degrees F. Therefore, the examiner maintains the position that it would have been obvious to a person having ordinary skill in the art to fuel heating and power generating combustion apparatus, such as water heaters, air heaters, jet engines and piston motors, with a known middle distillate Fischer-Tropsch derived fuel having a boiling points of between 160-400 degree C, in the manner set forth in applicant's claims. That is, at least for the purpose of taking advantage of the known clean nature (see US 6277894 (Agee et al)) of these Fischer-Tropsch derived synthetic fuels. More specifically, Fischer Tropsch products are considered "green fuels" and are desirable as environmentally friendly because they have very low levels of sulfur, nitrogen, aromatics and cycloparaffins, which if present during combustion are known to adversely affect the environment, for example, by producing acid rain **(See US006392108 (O'Rear)).**

**US 6102687 (Butcher)** shows and discloses:

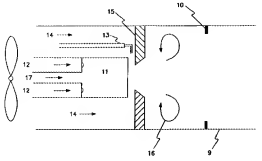



FIG. 2

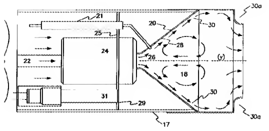



FIG. 3

(2) The invention relates to burning fuel more specifically, to a fuel burning combustion head using a low-pressure, high flow atomizing nozzle so that there will be a complete combustion resulting in a **minimum emission of pollutants.**

(3) For many years researchers have attempted to develop fuel burners which reduce emissions caused by unburned fuel. It has been discovered that a complete combustion of the fuel reduces emissions of pollutants particularly **carbon monoxide**, hydrocarbons, and soot. In burning liquid fuels, the problem is to provide sufficient oxygen for complete combustion of the carbon and hydrogen in the fuel to carbon dioxide and water, without high levels of excess air, which leads to reduced operating efficiency. This has led to an understanding that along with complete mixing, flame temperature and residence time affect the emissions levels released into the atmosphere. As a result **burners have been developed with a longer residence time and a lower flame temperatures (blue flame).** The prior art includes devices using fuel pressure atomizing recirculating burners (using no combustion air for atomization), high pressure air atomizing burners which use only a very small fraction of combustion air for atomization, and low pressure air atomizing burners which use a small percentage of the combustion air for atomization.

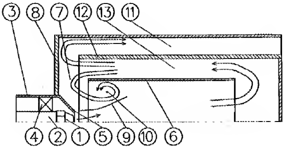
(3) As shown in **FIG. 1** the **oil fuel burner (1)** comprises a burner flame tube low pressure air atomizer nozzle (2). Primary air enters the flame zone through the atomizer (2). The low pressure air entering at (3) and low pressure fuel (8) accelerate and swirl as they exit the atomizer (2) as a swirling air jet with a fine spray entrained. The retention plate (5), baffle plate (7) and flame tube (1) confine the expanding jet forcing a toroidal recirculation pattern. **This recirculation zone (6) provides heat feedback necessary to stabilize the flame** supplied by the ignition source (4). **A strong flow in the recirculation zone (6) reduces the NOx emissions.** The invention comprises a new and unique combination fuel burner which uses a low pressure air atomizer (2) to create the desired **blue flame** effect. **In addition,** it provides for a unique configuration which creates a swirling effect of the combustion gases. This **swirling effect strongly influences the toroidal recirculation zone (6) leading to the recirculation into the flame of combustion products**. The combustion products can be relatively cool and low in oxygen. The baffle plate (7) defines the boundary of the toroidal recirculation zone. The **baffle plate (7) controls** the fraction of gas in the **recirculation zone** which comes from outside of the flame tube. **This improves the flames stability and lowers NOx emissions.** The size of the baffle plate (7) controls flames intensity. **A larger baffle generates a hotter, yellow flame and a more stable flame**, while **a smaller baffle plate creates** a **cooler bluer flame. The bluer, cooler flame is desired because it results in lower NOx emissio**n. By controlling the size of the baffle plate, the length of the flame tube the burner can operate in **either a blue or yellow flame mode.**

**DE 19834051 A1 (KOEHNE et al)**

ABSTRACT:

An improved design of burner for **liquid fuels** has the fuel and air mixture directed into a **vaporizing chamber (6)** coaxial inside the burn chamber (11) and with a return flow (13) between the two chambers. Part of the return flow, which has a c**old flame** effect, is ducted back into the **vaporizing chamber** to enhance the phase change of the fuel. The remainder of the **cold flame** effect mixture of **fuel vapour**, oxygen and other gasses passes into the burn chamber at a **reduced start temperature** for an improved burn without depositing cracking compounds anywhere in the system.

Fig. 3: Schnittdarstellung eines Brenners




**US 6305331 (Fullermann et al)** discloses a burner for a boiler:

The gas burner, designed in accordance to the intent of this invention, functions practically independently of the form or shape of the combustion chamber. It is especially suited for compact furnace designs with relatively short combustion chambers. The burner is not only suitable for burning gas. By replacing item 119 by a fuel injector that is appropriate for **liquid fuels** with the capability of generating a conical shroud spray pattern, the burner is then suitable for the combustion of **heating oil** **extra light**, " **Eco-oil"** or **kerosene.** With liquid fuels, the burner achieves **exhaust emission values for Nox of less than 60 mg/KW**.

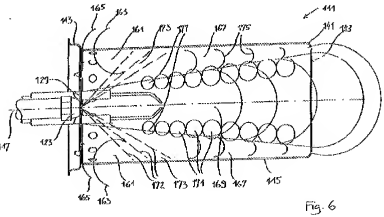


Fig. 6

**US 4846665 (Abbasi)**

The above examples show **reduction in the flue gas NO.sub.x** of up to over 80 percent achieved by the process of this invention. Higher NO.sub.x the fuel-rich and fuel-lean oscillations provided reduction was observed at lower excess air levels with lower oscillating frequencies and with moderate heat removal from the combustor. These conditions are consistent with operation of most industrial burners and combustors. Higher CO emissions were generally observed with low NO.sub.x emissions and can be burned out with enhanced mixing. **The process of this invention has a wide range of applications** for **both gas** and **oil firing** of **commercial** and **industrial boilers** and **water heaters** to heavy industrial processes such as glass melting. The process of this invention is particularly useful for regenerative combustors, such as regenerative glass melters, since combustion air flow may be maintained constant.As shown in FIG. 1, fuel introductory means 17 is fed fuel in a cyclic fashion from flow adjustment means 20. Any **gaseous or vaporous fuel** may be used in the combustion of this invention including **fossil derived** and **synthetic fuels.** Gaseous, liquid, vaporized liquid, pulverized solid, and solid/liquid mixed fuels may be used.

**US 3846979 (Pfefferle)**

The carbonaceous fuels utilized in the invention may be gaseous, liquid, or solid at normal temperature and pressure. **Suitable hydrocarbon fuels may include**, for example, low molecular weight aliphatic hydrocarbons such as methane, ethane, propane, butane, pentane; gasoline; aromatic hydrocarbons such as benzene, toluene, ethylbenzene, xylene; naphtha; **diesel** fuel; **jet** fuel; **other middle distillate fuels;** hydrotreated heavier fuels; and the like. Among the other useful carbonaceous fuels are alcohols such as methanol, ethanol, isopropanol; ethers such as diethylether and aromatic ethers such as ethylphenyl ether; **carbon monoxide**; and low ash chars.

Detailed Description Text - DETX (23):

In addition to employing the method of the present invention for **powering gas turbines**, the combustion system can be employed, for example, **as a heat source** in steam boilers wherein the heat of the exhaust gases are employed to generate steam as in a **water-tube boiler**, **air heaters**, **hot water heaters** and process furnaces.

## USPTO CUSTOMER CONTACT INFORMATION

Any inquiry concerning this communication or earlier communications from the examiner should be directed to CARL D. PRICE whose telephone number is (571) 272-4880. The examiner can normally be reached on Monday through Friday between 9:0am-5:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Steven B. McAllister can be reached on (571) 272-6785. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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